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Amended
liquid, said liquid jet recording head comprising:

a plurality of heating elements;

a heating element plate having electrodes for supplying electric current to said heating elements; and

an orifice formed of a resin having a hardness of Rockwell M65 to M120 and having an opening diameter equal to or less than 25 μm .--

REMARKS

The application has been reviewed in light of the Office Action dated May 22, 2002. By the present Amendment claim 36 has been added. Claims 26-36 are pending in this application, with claims 26 and 36 being in independent form. It is submitted that no new matter has been added and no new issues have been raised by the present Amendment.

Reconsideration is respectfully requested of the rejection of claims 26-27 and 30-35 under 35 U.S.C. § 103(a) as being allegedly unpatentable over U.S. Patent No. 5,278,584 (Keeffe et al.) in view of U.S. Patent No. 4,915,718 (Desai) and U.S. Patent No. 5,825,386 (Ohashi). Applicant has carefully considered the Examiner's comments and the cited art, and respectfully submits that independent claim 26 is patentable over the cited art, for at least the following reasons.

Independent claim 26 relates to a liquid jet recording head for ejecting a recording liquid from orifices toward a recording medium to accomplish a recording. The recording liquid is formed by dispersing fine particles in a liquid, and is applied to the recording medium in droplet form. The liquid jet recording head comprises a plurality of heating elements, a heating element

plate having electrodes for supplying electric current to the heating elements, and a cover plate molded by resin material. The cover plate forms a liquid reservoir storing the recording liquid and a plurality of passageways connected to the liquid chamber. An end of each passageway is connected to the liquid reservoir and an opposite end of each passageway serves as an outlet port. An opening of the outlet port has a diameter equal to or less than $25\ \mu\text{m}$. The resin material has hardness of Rockwell M65 to M120.

Keefe et al., as understood by Applicant, relates to an ink delivery system for an ink jet print head. A barrier layer containing ink channels is located between a rectangular substrate and a nozzle member containing an array of orifices. The substrate contains linear arrays of heater elements and each orifice in the nozzle member is associated with a vaporization chamber and heater element. The ink channels in the barrier layer have ink entrances generally running along opposite edges of the substrate so that ink flowing around the edges of the substrate gain access to the ink channels and to the vaporization chambers.

The Examiner notes that Keefe et al. does not disclose an outer port having a diameter equal to or less than $25\ \mu\text{m}$ as recited in claim 26 of the present application. Desai is cited as allegedly showing this missing element.

Desai, as understood by Applicant, relates to an ink jet nozzle structure and a method for fabricating the nozzle structure. In the method, photoform glass is initially exposed in a general configuration of ink chambers and nozzles to be formed, and two-step acid etching is performed with masking. Rigid transverse barriers are formed in precise locations in the exposing and developing steps at transition points between shallower sections and the deeper ink chamber area. These transverse lines are formed photographically by not exposing the lines to light in the photo

exposure step, leave the narrow lines substantially immune to the acid etching.

The Examiner contends that Desai allegedly discloses an opening of an outer port having a diameter equal to or less than $25\ \mu\text{m}$, with specific reference to col. 6, lns. 5-10 of Desai. Applicant respectfully disagrees. As understood by Applicant, Desai discloses two configurations each suitable for use as either an ink nozzle or an ink inlet (see Desai, col. 6, lns. 1-4; Figs. 10, 11). The width W_1 of the nozzle outlet (see id., Fig. 10) is disclosed to be "in the range of about 10 to 125 microns." In contrast, the diameter of the opening of the outlet port as disclosed in independent claim 26 of the present application is equal to or less than $25\ \mu\text{m}$. Therefore it is respectfully submitted that Desai discloses a range of outlet port values outside of the range disclosed by independent claim 26 of the present disclosure and does not teach or suggest the outlet port element as recited in independent claim 26 of the present application.

The Examiner further notes that Keefe et al. does not disclose a resin material having hardness of Rockwell M65 to M120 as recited in claim 26 of the present application. Ohashi is cited as allegedly showing this missing element.

Ohashi, as understood by Applicant, relates to a piezoelectric ink jet device and a method for manufacturing the device. An ink jet head has at least one actuator comprising conductive layers and piezoelectric ceramic layers that are alternately formed layer by layer in a cylindrical form to provide a hollow portion at the actuator center corresponding to an ink chamber. The ink chamber feeds ink from an ink feed source and the actuator(s) changes the volume of the ink chamber to cause the ink to jet out of the ink chamber. A voltage is applied to a pair of electrodes that are formed in the actuator(s).

The Examiner contends that Ohashi discloses a resin material having hardness of

Rockwell M65 to M120, with specific reference to col. 4, lns. 30-40 of Ohashi. Applicant respectfully disagrees. As understood by Applicant, Ohashi discloses a holder 5 made of epoxy resin, the resin having a "Rockwell hardness of from M-60 to M-130" (see Ohashi, col. 4, lns. 35-39), while the actuator(s) is formed of conductive layers and piezoelectric ceramic layers (see id., col. 4, lns. 40-42). As understood by Applicant, the holder disclosed by Ohashi serves to surround and hold the actuator(s) (see id., col. 4, lns. 34-35; Fig. 1), and it is the hollow portion of the actuator(s) that forms the ink chamber to be filled with ink (see id., col. 5, lns. 12-16; Figs. 1, 2). That is, as understood by Applicant, the holder 5 of Ohashi does not serve as an outlet port. The resin material having a hardness of Rockwell M65 to M120, as disclosed in independent claim 26 of the present application, is the substance from which the ends of the passageways servicing as outlet ports are formed. Therefore it is respectfully submitted that Ohashi does not teach or suggest this element as recited in independent claim 26 of the present application.

Furthermore, it is respectfully submitted that there is no motivation within the cited references to combine the references in the manner indicated in the Office Action, other than that possibly gleaned from the present disclosure. It is only the result of impermissible hindsight that allows the Examiner to combine the outlet port and resin elements as recited in independent claim 26 of the present application in the manner described in the Office Action.

Accordingly, for the above-stated reasons, Applicant respectfully submits that independent claim 26 is patentable over the cited references.

Claims 27-35 depend from independent claim 26, which for the reasons set forth above is thought to be patentable over the cited references and, for at least those same reasons, claims 27-

35 are thought to be patentable thereover.

New independent claim 36 has been added to further clarify and define the elements of the present application, and is believed to be patentable over the cited references for at least similar reasons.

Attached hereto is a version with markings to show changes made to the claims by the current Amendment.

The references cited as of interest have been reviewed, but are not seen to show or suggest the present invention as recited in the claims of the present application.

The Office is hereby authorized to charge any additional fees that may be required in connection with this Amendment and to credit any overpayment to our Deposit Account No. 03-3125.

If a petition for an additional extension of time is required to make this response timely, this paper should be considered to be such a petition, and the Commissioner is authorized to charge the requisite fees to our Deposit Account No. 03-3125.

If a telephone interview could advance the prosecution of this application, the Examiner is respectfully requested to call the undersigned attorney.

Entry of this amendment and allowance of this application are respectfully requested.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS

New claim 36 has been added:

--36. (New) A liquid jet recording head for ejecting a recording liquid toward a receiving medium so as to accomplish a recording by applying droplets of said recording liquid to said receiving medium, said recording liquid formed by dispersing fine particles in a liquid, said liquid jet recording head comprising:

a plurality of heating elements;

a heating element plate having electrodes for supplying electric current to said heating elements; and

an orifice formed of a resin having a hardness of Rockwell M65 to M120 and having an opening diameter equal to or less than 25 μ m.--

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